

**SIEMENS**

***c.cam 2.5***

**MI**

**DICOM Conformance Statement**

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## Document and Release History

### Document History

Revision	Date of Issue	Change & Reason of Change/Change Request/CHARM
Rev. 6	September, 2006	c.cam 2.03
Rev. 7	October, 2007	c.cam 2.1
Rev. 8 / 9	January 2009	c.cam 2.5 Added Modality Worklist support
Rev. 10	June 2009	c.cam 2.5 Update Modality Worklist support

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# 1 Introduction

## 1.1 Overview

This Conformance Statement describes the DICOM interface provided by c.cam / c.clear in terms of PS3.2 of [DICOM].

This introduction describes the DICOM functionality implemented in the application in general terms. It is assumed that readers are familiar with the DICOM standard and with the terminology and concepts used in that standard.

c.cam / c.clear is a medical imaging device providing the following DICOM services

- ☞ **Storage of NM images as SCU**
- ☞ **Basic Modality Worklist as SCU**
- ☞ **Verification as SCU**

## 1.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

## 1.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

The scope of this Conformance Statement is to describe supported communication with other applications. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [DICOM]. However, by itself there is no guarantee that just compliance to the standard will ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- Comparison of different conformance statements is the first step towards assessing interconnectivity between c.cam / c.clear and other DICOM equipment.
- Test procedures should be defined and tests should be performed by the user to validate the connectivity desired. DICOM compliance alone does not guarantee this.

This Conformance Statement is not intended to replace the actual validation of a connection to other DICOM equipment to ensure proper exchange of information.

## 1.4 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Additional abbreviations and terms are as follows:

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AE	DICOM Application Entity
ACN	Application Context Name
ASCII	American Standard Code for Information Interchange
DB	Database
DCS	DICOM Conformance Statement
DICOM	Digital Imaging and Communication in Medicine
DIMSE	DICOM Message Service Element
IOD	DICOM Information Object Definition
MI	Molecular Imaging
NEMA	National Electrical Manufacturers Association
NM	Nuclear Medicine
PDU	DICOM Protocol Data Unit
R	Required Key Attribute
RWA	Real-World Activity
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair

## 1.5 References

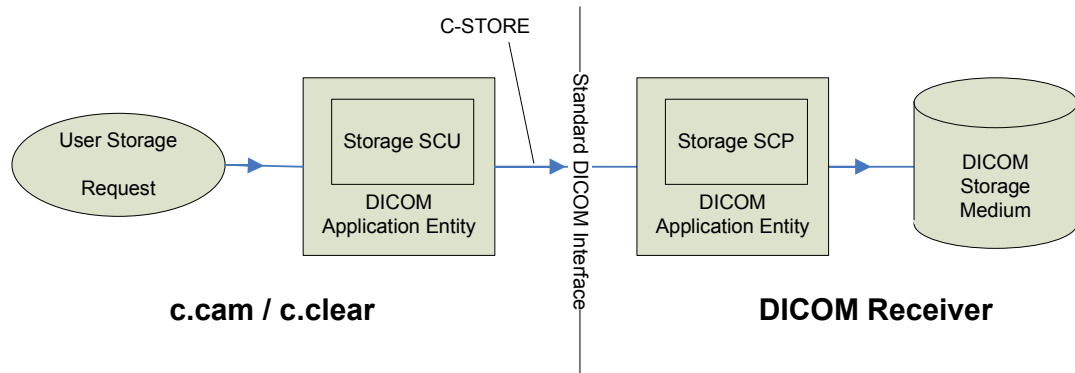
[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2006.

## 2 Implementation Model, Storage

c.cam / c.clear is able to establish a DICOM association for storing NM images by issuing a DICOM Association Request to another DICOM AE offering NM Image storage as SCP.

c.cam / c.clear acts as an SCU.

## 2.1 Application Data Flow Diagram



### 1: DICOM Storage as SCU

## 2.2 Functional Definitions of AE's

The c.cam / c.clear DICOM AE application data flow diagram above illustrates the supported DICOM option. This AE is started when the Application is started and establishes associations for NM image storage

Manually, when "Export" is pressed from the Patient Database view.

Automatically (if configured), when an examination has been successfully completed and a data series is ready.

The c.cam / c.clear DICOM AE is able to negotiate and establish a DICOM Association with any remote host supporting DICOM Storage as SCP sharing at least one of the supported Presentation Contexts, see section 4.1.2.2.

## 2.3 Sequencing of Real-World Activities

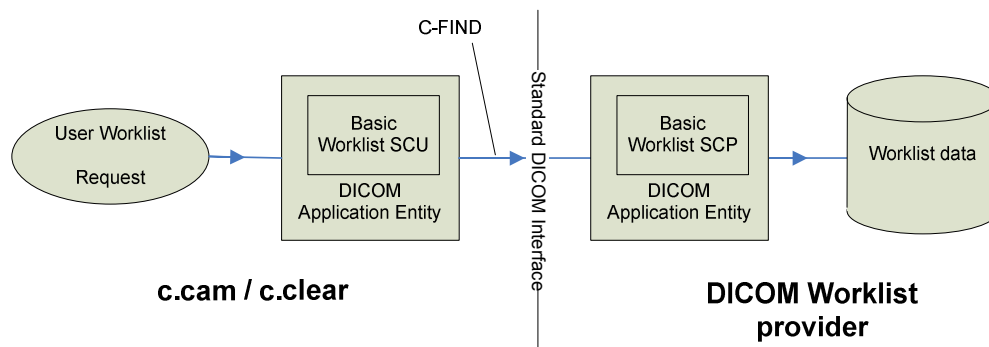
Not Applicable.

### 3 Implementation Model, Modality Worklist

c.cam / c.clear is able to establish a DICOM association for retrieving basic Worklist information by issuing a DICOM Association Request to another DICOM AE offering the Basic Modality Worklist service as SCP.

c.cam / c.clear acts as an SCU.

#### 3.1 Application Data Flow Diagram



#### 2: DICOM Modality Worklist as SCU

#### 3.2 Functional Definitions of AE's

The c.cam / c.clear DICOM AE application data flow diagram above illustrates the supported DICOM option. The Worklist AE is started when the Application is started.

The Worklist Request is issued:

- Manually, when "Apply" is pressed from the Worklist request configuration view.

The Modality Worklist Model submitted with the issued C-Find DIMSE service to the Worklist SCP is filled out with the entered matching criteria from the Manual Worklist Query edit fields.

- Automatically (if configured), when the scheduled automatic request time is reached.

The c.cam / c.clear DICOM Worklist AE is able to negotiate and establish a DICOM Association with any remote host supporting DICOM Worklist SCP (Worklist server).

The Worklist SCP responses to the C-Find query holds data for patient demographics and scheduled procedure steps and will be visible in the scheduler database after the query.

### 3.3 Sequencing of Real-World Activities

Not Applicable.

## 4 AE Specification

The c.cam / c.clear DICOM AE provides standard conformance to the following DICOM V3.0 SOP Class in the role of SCU:

SOP Class Name	SOP Class UID
Nuclear Medicine Image Information Object Storage	1.2.840.10008.5.1.4.1.1.20
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31

### 4.1 Storage

#### 4.1.1 Association Establishment Policies

The associated Real-World activity is an application storage request, causing the c.cam / c.clear to initiate an Association Negotiation with the Storage SCP. After successful negotiation with that remote DICOM AE, the c.cam / c.clear sends a single image as a C-STORE DIMSE operation via the open association and closes the association again.

If more images are to be stored, new associations are established for those.

##### 4.1.1.1 Number of Associations

c.cam / c.clear only initiates and supports a single association at a time.

##### 4.1.1.2 Asynchronous Nature

c.cam / c.clear does not support asynchronous communication (multiple outstanding transactions over a single association).

##### 4.1.1.3 Implementation Identifying Information

The c.cam / c.clear DICOM AE uses the following implementation Class UID identifying the different DICOM services it supports:

Implementation Class UID	1.2.840.114080.1.0.2
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#### 4.1.2 Association Initiation Policy

The c.cam / c.clear DICOM AE initiates the DICOM Association Negotiation to issue the DICOM C-STORE request.

##### 4.1.2.1 Associated Real-World Activity

The user initiates the establishment of an Association when a particular image from the local database is to be transferred to the remote host.

This can be

- a. When “Export” is issued manually
- b. If Auto-export is activated, when an examination has been successfully completed and a data series is ready.

If the C-STORE Response from the remote Application contains another status than “Success” or “Warning”, the user is informed of the problem.

#### 4.1.2.2 Proposed Presentation Context Table

The c.cam / c.clear DICOM AE will propose and accept a single Presentation Context for the association as defined by Table 1:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Table 1 Presentation Context

#### 4.1.2.3 SOP Specific Conformance

The DICOM images created by the c.cam / c.clear DICOM application conform to the DICOM NM IOD definition, defined in PS3.3, Section A.5, of [DICOM].

Please see Appendix A, DICOM NM IOD Attribute for a list of used standard as well as private IOD attributes.

#### 4.1.3 Association Acceptance Policy

c.cam / c.clear does not accept remote negotiation initiation.

##### 4.1.3.1 Associated Real-Word Activity

Not applicable.

##### 4.1.3.2 Presentation Context Table

Not applicable.

##### 4.1.3.3 SOP Specific Conformance

Not applicable.

#### 4.1.3.4 Presentation Context Acceptance Criterion

Not applicable.

#### 4.1.3.5 Transfer Syntax Selection Policies

Not applicable.

### 4.2 Modality Worklist

#### 4.2.1 Association Establishment Policies

The associated Real-World activity is an application Worklist request, causing the c.cam / c.clear to initiate an Association Negotiation with the Worklist SCP. After successful negotiation with that remote DICOM AE, the c.cam / c.clear sends a request and receives responses if any.

##### 4.2.1.1 Number of Associations

c.cam / c.clear only initiates and supports a single association at a time.

##### 4.2.1.2 Asynchronous Nature

c.cam / c.clear does not support asynchronous communication (multiple outstanding transactions over a single association).

##### 4.2.1.3 Implementation Identifying Information

The c.cam / c.clear DICOM AE uses the following implementation Class UID identifying the different DICOM services it supports:

Implementation Class UID	1.2.840.114080.1.0.2
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#### 4.2.2 Association Initiation Policy

The c.cam / c.clear DICOM AE initiates the DICOM Association Negotiation to issue the Modality Worklist (C-FIND) DICOM request.

##### 4.2.2.1 Associated Real-World Activity

The establishment of an Association is initiated when a Worklist is requested.

This can be

- a. Issued manually when “Apply” in Worklist request configuration view is pressed.
- b. Issued automatically when the scheduled Worklist request time is reached.

If the C-FIND Response from the remote Application contains another status than “Success” or “Warning”, the user is informed of the problem.

##### 4.2.2.2 Proposed Presentation Context Table

The c.cam / c.clear DICOM AE will propose and accept a single Presentation Context for the association as defined by **Table 2**:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Management	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

**Table 2 Presentation Context**

### 4.2.2.3 SOP Specific Conformance

The DICOM Worklist query created by the c.cam / c.clear DICOM application conform to the DICOM Basic Worklist Information model definition, defined in PS3.4, Section K.6.1, of [DICOM].

Please see Annex B:Worklist for a list of tags that compose the request.

### 4.2.3 Association Acceptance Policy

c.cam / c.clear does not accept remote negotiation initiation.

#### 4.2.3.1 Associated Real-Word Activity

Not applicable.

#### 4.2.3.2 Presentation Context Table

Not applicable.

#### 4.2.3.3 SOP Specific Conformance

Not applicable.

#### 4.2.3.4 Presentation Context Acceptance Criterion

Not applicable.

#### 4.2.3.5 Transfer Syntax Selection Policies

Not applicable.

## 5 Communication Profiles

### 5.1 Supported Communication Stacks

The c.cam / c.clear DICOM implementation provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM standard, utilizing the Microsoft Windows Socket technology.

The product target Operating System is Microsoft Windows XP Professional.

## **5.2 TCP/IP Stack**

The c.cam / c.clear DICOM application uses the TCP/IP stack from the target operating system upon which it executes.

## **5.3 Physical Media Support**

The c.cam / c.clear DICOM application is indifferent to the physical medium over which TCP/IP executes. It inherits the TCP/IP from the target operating system upon which it executes.

## **6 Configuration**

The AE Title used by the c.cam / c.clear DICOM AE is set in a configuration. The AE Title, by default is the station name where the application is running and is shared between the Modality Worklist and the Storage services.

The TCP port number for Storage SCU is 104, which is not configurable.

The max PDU length is 16384 and is not configurable.

## **7 Support of Extended Character Sets**

The c.cam / c.clear DICOM application supports the ISO 8859 Latin 1 (ISO-IR 100) character set.

## Annex A: Appendix A, DICOM NM IOD Attribute Usage

The following attributes are used by the c.cam / c.clear DICOM storage SCU application, ref. DICOM standard, Part 3 (PS 3.3), section A.5.

### A.1 IE: Patient

Module	Tag	Attribute Name	Type
Patient	(0010,0010)	PatientName	PN
	(0010,0020)	PatientID	LO
	(0010,0030)	PatientBirthDate	DA
	(0010,0040)	PatientSex	CS
Patient Demographic	(0010,1020)	PatientSize	DS
	(0010,1030)	PatientWeight	DS

### A.2 IE: Study

Module	Tag	Attribute Name	Type
General Study	(0008,0020)	StudyDate	DA
	(0008,0030)	StudyTime	TM
	(0008,0050)	AccessionNumber	SH
	(0008,0090)	ReferringPhysiciansName	PN
	(0008,1030)	StudyDescription	LO
	(0008,1060)	NameOfPhysiciansReadingStudy	PN
	(0020,000d)	StudyInstanceUID	UI
	(0020,0010)	StudyID	SH

### A.3 IE: Series

Module	Tag	Attribute Name	Type
General Series	(0008,0021)	SeriesDate	DA
	(0008,0031)	SeriesTime	TM
	(0008,0060)	Modality	CS
	(0008,103e)	SeriesDescription	LO
	(0018,1030)	ProtocolName	LO
	(0020,000e)	SeriesInstanceUID	UI
	(0020,0011)	SeriesNumber	IS
Patient Orientation	(0054,0410)	PatientOrientationCodeSequence	SQ
	(0008,0100)	> CodeValue	SH
	(0008,0102)	> CodingSchemeDesignator	SH
	(0008,0104)	> CodeMeaning	LO
	(0054,0412)	> PatientOrientationModifierCodeSequence	SQ
	(0008,0100)	>> CodeValue	SH
	(0008,0102)	>> CodingSchemeDesignator	SH
(0008,0104)	>> CodeMeaning	LO	

Module	Tag	Attribute Name	Type
	(0054,0414)	PatientGantryRelationshipCodeSequence	SQ
	(0008,0100)	> CodeValue	SH
	(0008,0102)	> CodingSchemeDesignator	SH
	(0008,0104)	> CodeMeaning	LO

#### A.4 IE: Frame of Reference

Module	Tag	Attribute Name	Type
Frame of Reference	(0020,0052)	FrameOfReferenceUID	UI
	(0020,1040)	PositionReferenceIndicator	LO

#### A.5 IE: Equipment

Module	Tag	Attribute Name	Type
General Equipment	(0008,0070)	Manufacturer	LO
	(0008,0080)	InstitutionName	LO
	(0008,0081)	InstitutionAddress	ST
	(0008,1010)	StationName	SH
	(0008,1090)	ManufacturerModelName	LO
	(0018,1000)	DeviceSerialNumber	LO
	(0018,1020)	SoftwareVersion	LO

#### A.6 IE: Image

Module	Tag	Attribute Name	Type
General Image	(0008,0022)	AcquisitionDate	DA
	(0008,0023)	ContentDate	DA
	(0008,0032)	AcquisitionTime	TM
	(0008,0033)	ImageTime	TM
	(0020,0013)	InstanceNumber	IS
	(0020,0020)	PatientOrientation	CS
	(0020,4000)	ImageComments	LT
Image Pixel Macro	(0028,0010)	Rows	US
	(0028,0011)	Columns	US
	(0028,0103)	PixelRepresentation	US
	(0028,0106)	SmallestImagePixelValue	US
	(0028,0107)	LargestImagePixelValue	US
Acquisition Context	(0040,0555)	AcquisitionContextSequence	SQ
	(0040,a043)	> ConceptNameCodeSequence	SQ
	(0008,0100)	>> CodeValue	SH
	(0008,0102)	>> CodingSchemeDesignator	SH
	(0008,0104)	>> CodeMeaning	LO
	(0040,a168)	> ConceptCodeSequence	SQ

Module	Tag	Attribute Name	Type
	(0008,0100)	>> CodeValue	SH
	(0008,0102)	>> CodingSchemeDesignator	SH
	(0008,0104)	>> CodeMeaning	LO
NM Image Pixel	(0028,0002)	SamplesPerPixel	US
	(0028,0004)	PhotometricInterpretation	CS
	(0028,0030)	PixelSpacing	DS
	(0028,0100)	BitsAllocated	US
	(0028,0101)	BitsStored	US
	(0028,0102)	HighBit	US
Multi-frame	(0028,0008)	NumberOfFrames	IS
NM Multi-Frame	(0028,0009)	FrameIncrementPointer	AT
	(0054,0010)	EnergyWindowVector	US
	(0054,0011)	NumberOfEnergyWindows	US
	(0054,0020)	DetectorVector	US
	(0054,0021)	NumberOfDetectors	US
	(0054,0030)	PhaseVector	US
	(0054,0031)	NumberOfPhases	US
	(0054,0050)	RotationVector	US
	(0054,0051)	NumberOfRotations	US
	(0054,0060)	RRIntervalVector	US
	(0054,0061)	NumberOfRRIntervals	US
	(0054,0070)	TimeSlotVector	US
	(0054,0071)	NumberOfTimeSlots	US
	(0054,0080)	SliceVector	US
	(0054,0081)	NumberOfSlices	US
	(0054,0090)	AngularViewVector	US
	(0054,0100)	TimeSliceVector	US
NM Image	(0008,0008)	ImageType	CS
	(0018,0070)	CountsAccumulated	IS
	(0018,1242)	ActualFrameDuration	IS
	(0028,0051)	CorrectedImage	CS
NM Isotope	(0054,0012)	EnergyWindowInformationSequence	SQ
	(0054,0018)	> EnergyWindowName	SH
	(0054,0013)	> EnergyWindowRangeSequence	SQ
	(0054,0014)	>> EnergyWindowLowerLimit	DS
	(0054,0015)	>> EnergyWindowUpperLimit	DS
	(0054,0016)	RadiopharmaceuticalInformationSequence	SQ
	(0018,0031)	> Radiopharmaceutical	LO
	(0018,1074)	> RadionuclideTotalDose	DS
	(0054,0300)	> RadionuclideCodeSequence	SQ
	(0008,0100)	>> CodeValue	SH

Module	Tag	Attribute Name	Type
	(0008,0102)	>> CodingSchemeDesignator	SH
	(0008,0104)	>> CodeMeaning	LO
NM Detector	(0054,0022)	DetectorInformationSequence	SQ
	(0018,1110)	> DistanceSourceToDetector	DS
	(0018,1142)	> RadialPosition	DS
	(0018,1180)	> CollimatorGridName	SH
	(0018,1181)	> CollimatorType	CS
	(0018,1182)	> FocalDistance	IS
	(0020,0032)	> ImagePositionPatient	DS
	(0020,0037)	> ImageOrientationPatient	DS
	(0028,0031)	> ZoomFactor	DS
	(0054,0200)	> StartAngle	DS
NM Tomo Acq	(0054,0052)	RotationInformationSequence	SQ
	(0018,1140)	> RotationDirection	CS
	(0018,1143)	> ScanArc	DS
	(0018,1144)	> AngularStep	DS
	(0018,1242)	> ActualFrameDuration	IS
	(0054,0053)	> NumberOfFramesInRotation	US
	(0054,0200)	> StartAngle	DS
	(0054,0202)	TypeOfDetectorMotion	CS
NM Multi-gated Acq	(0018,1088)	HeartRate	IS
	(0054,0062)	GatedInformationSequence	SQ
	(0054,0063)	> DataInformationSequence	SQ
	(0018,1062)	>> NominalInterval	IS
	(0018,1063)	>> FrameTime	DS
	(0018,1081)	>> LowRRValue	IS
	(0018,1082)	>> HighRRValue	IS
	(0018,1083)	>> IntervalsAcquired	IS
	(0018,1084)	>> IntervalsRejected	IS
NM Phase	(0054,0032)	PhaseInformationSequence	SQ
	(0018,1242)	> ActualFrameDuration	IS
	(0054,0033)	> NumberOfFramesInPhase	US
	(0054,0036)	> PhaseDelay	IS
	(0054,0038)	> PauseBetweenFrames	IS
SOP Common	(0008,0005)	SpecificCharacterSet	CS
	(0008,0016)	SOPClassUID	UI
	(0008,0018)	SOPInstanceUID	UI
(Siemens syngo private)		PrivateCreator	
	(0055,0010)	("SIEMENS MED NM")	LO
		CSA_AUX_0055_7E / Collimator Thickness	
	(0055,107e)	(Value in mm, VM = 2 for dual head)	FL

Module	Tag	Attribute Name	Type
		CSA_AUX_0055_7E / Collimator Angular Resolution	
	(0055,107f)	(Value in radians)	FL
		PrivateCreator	
	(7fe3,0010)	("SIEMENS MED NM")	LO
	(7fe3,1029)	NumberOfRWavesInFrame	OW
		PrivateCreator	
	(0033,0010)	("SIEMENS MED NM")	LO
		Crystal thickness	
	(0033,1029)	(Value in mm, VM = 2 for dual head)	FL
		Camera config Angle	
	(0033,1031)	(90 degrees)	FL
		Crystal Type	
	(0033,1032)	("Solid")	LO
		PrivateCreator	
	(0035,0010)	("SIEMENS MED NM")	LO
		Specialized Tomo Type	
	(0035,1000)	("TOMO_PROFILE_2")	LO
		Energy Window Type	
	(0035,1001)	(one of the following: transmission, emission, emission scattered or transmission scattered)	LO
		Wing Position	
	(0035,1002)	(Start and End Row Illuminated by Wing Position)	SS

## Annex B: Worklist Tags

Below is the structure of the Basic Modality Worklist information model used in the Worklist requests. Datasets like the ones below are returned, one per query hit.

The contents of the tags in the request are filled out from the relevant fields in the GUI, but they can be individually configured in the WLQuery.txt file available in the c:\virgo\dicom folder.

Before editing the WLQuery.txt file, make a copy of it for reference and in case it is needed. When editing the file, do not change the layout/structure. Only change the value of the attributes with the following values:

- “?” to fill in with available data
- “N/A” do not fill in with available data
- “xxx” to fill in the value regardless of the GUI values.

Data returned in these attributes are replicated untouched to the storage IOD, when images are stored.

Tag	Type	Attribute Name
(0040,0100)	SQ	ScheduledProcedureStepSequence
(0040,0001)	AE	ScheduledStationAETitle
(0040,0002)	DA	ScheduledProcedureStepStartDate
(0040,0003)	TM	ScheduledProcedureStepStartTime
(0008,0060)	CS	Modality
(0040,0006)	PN	ScheduledPerformingPhysiciansName
(0040,0007)	LO	ScheduledProcedureStepDescription
(0040,0010)	SH	ScheduledStationName
(0040,0011)	SH	ScheduledProcedureStepLocation
(0040,0008)	SQ	ScheduledActionItemCodeSequence
(0008,0100)	SH	CodeValue
(0008,0102)	SH	CodingSchemeDesignator
(0008,0104)	LO	CodeMeaning
(0040,0012)	LO	PreMedication
(0040,0009)	SH	ScheduledProcedureStepID
(0032,1070)	LO	RequestedContrastAgent
(0040,1001)	SH	RequestedProcedureID
(0040,1002)	LO	ReasonForRequestedProcedure
(0032,1064)	SQ	RequestedProcedureCodeSequence
(0008,0100)	SH	CodeValue
(0008,0102)	SH	CodingSchemeDesignator
(0008,0104)	LO	CodeMeaning
(0032,1060)	LO	RequestedProcedureDescription
(0020,000d)	UI	StudyInstanceUID
(0032,1032)	PN	RequestingPhysician
(0008,0090)	PN	ReferringPhysiciansName
(0008,0050)	SH	AccessionNumber
(0010,0010)	PN	PatientName
(0010,0020)	LO	PatientID
(0010,0030)	DA	PatientBirthDate
(0010,0040)	CS	PatientSex
(0010,1020)	DS	PatientSize
(0010,1030)	DS	PatientWeight
(0038,0500)	LO	PatientState
(0010,21c0)	US	PregnancyStatus
(0010,2000)	LO	MedicalAlerts
(0010,2110)	LO	ContrastAllergies

(0038,0050)	LO	SpecialNeeds
(0040,1400)	LT	RequestedProcedureComments
(0008,1030)	LO	StudyDescription
(0010,1000)	LO	OtherPatientID
(0040,1010)	PN	IntendedRecipients
(0040,2400)	LT	ImageServiceRequestComments
(0040,2001)	LO	ImageServiceRequestReason